CLAIMS

WHAT IS CLAIMED IS:

1. A rolling cone rock bit, comprising:

a drill bit body defining a gage diameter at which the rolling cone rock bit is designed to ream a borehole;

a first leg on said drill bit body, said first leg having a leg backface;

a rolling cone attached to said first leg at said lower end of said drill bit body, said rolling cone including a plurality of rolling cone cutters, none of said rolling cone cutters extending to said gage diameter;

a first plurality of cutting elements mounted on said leg backface of said first leg, said plurality of cutting elements having at least one cutting element with a cutting tip that extends to said gage diameter.

2. The rolling cone rock bit of claim 1, wherein said plurality of cutting elements are disposed in a curved row on said first leg.

3. The rolling cone rock bit of claim 1, wherein a majority of said first plurality of cutting elements have cutting tips that extend to gage diameter.

4. The rolling cone rock bit of claim 1, wherein said plurality of cutting elements are disposed on a leading edge of said first leg.

5. The rolling cone rock bit of claim 4, further comprising:

a second leg on said drill bit body, said second leg having a leg backface;

a rolling cone attached to said second leg at said lower end of said drill bit body;

a second plurality of cutting elements mounted on said leg backface of said second leg, said second plurality of cutting elements having at least one cutting element with a cutting tip that extends to said gage diameter.

6. The rolling cone rock bit of claim 5, wherein said first plurality of cutting elements is staggered with respect to said second plurality of cutting elements when said first plurality and second plurality are placed in rotated profile to result in an overlap between every cutting element of said first plurality of cutting elements with cutting elements of said second plurality of cutting elements.

7. The rolling cone rock bit of claim 1, wherein said first leg includes a leading edge having a lower region extending from proximate said lower end of said drill bit and an upper end, said leading edge having a first portion disposed from said drill bit's longitudinal axis at a first angle, whereby said leading edge provides a surface for the flow of drilling fluid from the bottom of a wellbore.

8. The rolling cone rock bit of claim 1, further comprising:

a nozzle boss having a nozzle boss lower end and a nozzle boss upper end;

a fluid flow channel formed from said leading edge and said nozzle boss, the cross-sectional area of said fluid flow channel being greater at said nozzle boss upper end than at said nozzle boss lower end.

9. The rolling cone rock bit of claim 1, wherein said first plurality of cutting elements are polycrystalline diamond cutters.

10. The rolling cone rock bit of claim 1, wherein said first plurality of cutting elements are steel teeth.

11. The rolling cone rock bit of claim 10, wherein said steel teeth are coated with a wear resistant material.

12. The rolling cone rock bit of claim 1, wherein said first plurality of cutting elements are carbide inserts.

13. The rolling cone rock bit of claim 1, wherein said drill bit body has a circumference of 360 degrees, at least 150 degrees around the circumference of said drill bit body being covered by inserts disposed on the outer periphery of said drill bit body.

14. The rolling cone rock bit of claim 13, wherein a majority of said inserts extend to gage diameter.

15. The rolling cone rock bit of claim 13, wherein a majority of said inserts do not extend to gage diameter.

16. The rolling cone rock bit of claim 13, wherein at least 180 degrees of said circumference of said drill bit body is covered by said inserts disposed on the outer periphery of said drill bit body.

17. The rolling cone rock bit of claim 13, wherein at least 200 degrees of said circumference of said drill bit body is covered by said inserts disposed on the outer periphery of said drill bit body.

18. A rolling cone rock bit, comprising:

a drill bit body defining a gage diameter at which the rolling cone rock bit is designed to drill a borehole;

a first leg on said drill bit body, said first leg having a leading edge;

a rolling cone attached to said first leg at a lower end of said drill bit body;

at least one cutting element on said leading edge of said first leg, said at least one cutting element extending to said gage diameter.

19. The rolling cone rock bit of claim 18, wherein said rolling cone includes a plurality of cutting teeth extending to said gage diameter.

20. The rolling cone rock bit of claim 18, wherein said rolling cone does not include any cutting element extending to said gage diameter.

21. The rolling cone rock bit of claim 18, further comprising:

a second leg on said drill bit body, said second leg having a leading edge;

a plurality of cutting elements on said leading edge of said second leg, said at least one cutting element on said second leg extending to said gage diameter; and

wherein said at least one cutting element on said first leg is staggered in rotated profile to said plurality of cutting elements on said second leg.

22. The rolling cone rock bit of claim 18, wherein a portion of said leading edge of said first leg is disposed at a non-zero angle from a longitudinal axis of said drill bit body, wherein said leading edge forms a surface for the flow of drilling fluid from the bottom of said borehole.

23. A rolling cone rock bit, comprising:

a drill bit body defining a longitudinal axis, a top, and a bottom;

a first leg formed from said drill bit body, said first leg providing a mud flow ramp from a leading edge of said first leg, wherein said mud flow ramp is disposed at an angle to said longitudinal axis, and wherein said mud flow ramp has a top;

a junk slot defined by said mudflow ramp, drill bit body, and a junk slot boundary line;

a first rolling cone rotatably attached to said drill bit body,

wherein said junk slot has a cross-sectional area at each height along said junk slot and said cross-sectional area of said junk slot is greater at its top than at its bottom.

24. The rolling cone rock bit of claim 23, further comprising:

a nozzle boss formed from said drill bit body, said nozzle boss having a bottom;

wherein said junk slot is further defined by said nozzle boss, and where said cross-sectional area of said junk slot is greater at said top of said mud ramp than at said bottom of said nozzle boss.

25. The rolling cone rock bit of claim 23, wherein said junk slot boundary line is defined by the rotational movement of an outermost point on said first leg.

26. The rolling cone rock bit of claim 23, further comprising:

a second leg formed from said drill bit body, said second leg being adjacent to but leading said first leg,

wherein said nozzle boss is forms a side of said second leg.

27. The rolling cone rock bit of claim 23, wherein one side wall of every leg of said rolling cone rock bit is also a side of a nozzle boss.

28. The rolling cone rock bit of claim 23, wherein said mud ramp includes a first straight section and a second straight section.

29. The rolling cone rock bit of claim 28, wherein said first and second straight sections are disposed from said longitudinal axis between 0 and 80 degrees.

30. The rolling cone rock bit of claim 29, wherein said first and second straight sections are disposed from said longitudinal axis between 10 and 80 degrees.

31. The rolling cone rock bit of claim 29, wherein said first and second straight sections are disposed from said longitudinal axis between 0 and 60 degrees.

32. The rolling cone rock bit of claim 29, wherein said first and second straight sections are connected with a fillet surface.

33. The rolling cone rock bit of claim 28, wherein said first straight section is angularly displaced from said second straight section.

34. The rolling cone rock bit of claim 23, wherein said mud flow ramp includes a concave section.

35. The rolling cone rock bit of claim 23, wherein said mud flow ramp includes a convex section.

36. The rolling cone rock bit of claim 23, wherein said mud flow ramp is a set of continuous curves.

37. The rolling cone rock bit of claim 23, wherein said mud flow ramp is a set of continuous curves.

38. The rolling cone rock bit of claim 23, wherein said bit body has cylindrical shape.

39. The rolling cone rock bit of claim 23, wherein said bit body has an conical shape.

40. The rolling cone rock bit of claim 23, wherein said bit body ahs a revolved shape.

41. The rolling cone rock bit of claim 23, further comprising:

a grease reservoir located on the top of the mud flow ramp.

42. The rolling cone rock bit of claim 23, further comprising:

a grease reservoir located on the mud flow ramp surface.

43. The rolling cone rock bit of claim 23, wherein said first leg is backturned.

44. The rolling cone rock bit of claim 23, further comprising:

a nozzle attached to said drill bit body; and

a fluid flow channel formed between said nozzle and said mud flow ramp.

45. The rolling cone rock bit of claim 43, wherein a side wall forming said nozzle also forms a side wall to a leg.

46. The rolling cone rock bit of claim 23, wherein said first leg has a backface at the periphery of said drill bit body, and said backface is parallel to said longitudinal axis.

47. The rolling cone rock bit of claim 23, wherein said first leg has a backface at the periphery of said drill bit body, said backface being tapered at an angle to said longitudinal axis.

48. The rolling cone rock bit of claim 45, wherein said angle is less than ½ degree.

49. The rolling cone rock bit of claim 23, where said cross-sectional area of said junk slot continuously increases from said bottom of said nozzle boss to said top of said mud ramp.

50. The rolling cone rock bit of claim 23, where said cross-sectional area of said junk slot at said top of said mud ram is at least 15% greater than said cross-sectional area of said junk slot at said bottom of said nozzle boss.

51. The rolling cone rock bit of claim 23, where said cross-sectional area of said junk slot at said top of said mud ram is at least 100% greater than said cross-sectional area of said junk slot at said bottom of said nozzle boss.

52. The rolling cone rock bit of claim 23, where said cross-sectional area of said junk slot at said top of said mud ram is between 15% and 600% greater than said cross-sectional area of said junk slot at said bottom of said nozzle boss.

53. A drill bit for use in a borehole, comprising:

a drill bit body defining a longitudinal axis,

a leg on a side of said drill bit body; and

a mud ramp formed from said leg, said mud ramp having a surface for pumping mud from a borehole bottom;

wherein said surface of said mud ramp has a first portion corresponding to a first angle from said longitudinal axis, and a second portion corresponding to a second angle from said longitudinal axis, where said second angle is different from said first angle.

54. The drill bit of claim 53, wherein said first portion is a first straight section.

55. The drill bit of claim 54, wherein said second portion is a second straight section.

56. The drill bit of claim 53, wherein said first portion is a first point on a first curve and said first angle is measured from a tangent to said first point.

57. The drill bit of claim 53, wherein said first portion is a first point on a first curve and said first angle is measured from a tangent to said first point.

58. A drill bit, comprising:

a drill bit body defining a gage diameter at which the rolling cone rock bit is designed to drill a borehole;

a first leg on said drill bit body;

a rolling cone attached to said first leg at a lower end of said drill bit body, a most upper portion of said rolling cone being at a first height;

at least one cutting element on said first leg, said at least one cutting element extending below said first height.

59. The drill bit of claim 58, wherein said rolling cone includes at least one cutter extending to said gage diameter.

60. The drill bit of claim 58, wherein said rolling cone does not include any cutter extending to said gage diameter.

61. The drill bit of claim 58, further comprising:

a second leg on said drill bit body;

a second rolling cone attached to said second leg at a lower end of said drill bit body, a most upper portion of said second rolling cone being at a second height;

at least one cutting element on said second leg, said at least one cutting element on said second leg extending below said second height.

62. The drill bit of claim 61, wherein said at least one cutting element on said first leg has a cutting tip and said at least one cutting element on said second leg has a cutting tip, and further wherein said cutting tips of said at least one cutting element on said first leg and said at least one cutting element on said second leg are at different heights.

63. The drill bit of claim 58 wherein said first leg has a rotational leading side, said at least one cutting element being disposed on said rotational leading side.

64. The drill bit of claim 63, wherein said rotational leading side of said first leg forms one boundary for a junk slot suitable to carry drilling fluid.